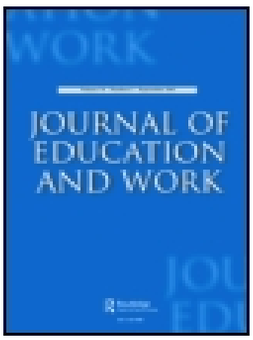

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Economic returns to adult vocational qualifications

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ABSTRACT

Some countries have certifying institutions for competence acquired at the workplace. These institutions provide incentives for workplace training that may have favourable effects on productivity, earnings and labour market participation. We present evidence on the earnings effects of attaining vocational qualifications in adulthood through two alternative routes: (1) apprenticeship and (2) recognition and testing of vocational competence acquired through relevant work experience. Drawing on longitudinal administrative data from Norway and tracking the labour market careers of individuals without completed upper secondary education by age 25, we estimate the impacts of acquiring vocational qualifications on future labour earnings. To allow for differential labour market trajectories of those who do and do not acquire qualifications, we account for unobserved individual heterogeneity in both levels and earnings growth. Without a rich representation of unobserved heterogeneity, estimated earnings effects are exaggerated. We find that vocational qualifications from both the apprenticeship and the experience-based routes boost earnings of men and women. Certification of already acquired skills has some value in itself, but adult apprenticeships have more positive effects on future earnings, as they involve greater individual skills development.

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Vocational education and training; returns to training; apprenticeships; certification

1. Introduction

Across rich countries, a large fraction of youth leaves school early and enters adulthood without an upper secondary qualification (Eurostat 2018). However, many return to formal education later, and others accumulate skills through work experience and firm-based training. In contrast to formal schooling qualifications, firm-based training achievements are usually not verified by external institutions. Consequently, labour market returns through job mobility can be limited and training contracts between workers and firms difficult to enforce (Dustmann and Schönberg 2012), suggesting that external certification of skills may enhance the labour market value of such training (Acemoglu and Pischke 2000). The empirical literature on the effects of formal vocational education for adults shows divergent results, depending on features of both the labour market and the educational system. Participation in adult learning activities may be rewarded through increased human capital and improved productivity (Becker 1962), and through signalling of personal characteristics such as motivation (Spence 1973) and trainability and willingness to learn (Dieckhoff 2007). Turning workplace learning into formal qualifications may inform prospective employers about skills and desirable personal characteristics.[1] External verification of skills acquired through workplace learning is therefore likely to affect the labour market returns to such investments.

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In this article, we use longitudinal register data from Norway to study individuals without completed upper secondary education by age 25 and estimate the economic returns to acquiring formal vocational qualifications as adults. For adults, there are two alternative pathways to formal vocational qualifications at the upper secondary education level. First, adults can have their non-formal occupational competence assessed and certified, provided they can document sufficient relevant work practice and pass an exam and a practical-theoretical test. The second route is through ordinary apprenticeship programmes, involving a larger component of skills development. As such, the two routes to the same formal qualifications have different implications for human capital development, which allows us to analyse the specific value of formal certification of skills already acquired at the workplace compared to acquiring qualifications through apprenticeships. Our article provides an analysis of a policy-relevant system of recognition and testing of vocational competence whereby non-formal workplace learning can be turned into formal vocational qualifications. We analyse the findings in the institutional context of a coordinated Norwegian labour market regime and a hybrid apprenticeship-based vocational education and training (VET) system, where employers influence, but do not decide on the contents of the VET curriculum.

As with the estimation of economic returns to schooling in general, causal effects of vocational qualifications are hard to identify as individuals choose themselves whether to upgrade their skills. We expect that those who upgrade their qualifications as adults differ from those who do not, and this hypothesis is strongly confirmed by the data. Full population individual longitudinal data from administrative registers enable us to estimate earnings effects based on fixed effects analyses with individual components of wage growth, richly accounting for unobserved individual heterogeneity. We observe individual earnings of members of the 1973–1982 birth cohorts who did not complete upper secondary education by age 25 and follow their labour market career for about 15 years. Such data permit better identification strategies than those typically used in the literature and we show that without the rich representation of unobserved heterogeneity, the economic returns to adult vocational qualifications will be overestimated.

2. Related literature

The literature on labour market outcomes of training and education for adults is diverse, both regarding the type of training/education studied – i.e. formal vs. non-formal, general vs. vocational, tertiary vs. secondary – and regarding what academic debate they address. Our study relates most closely to the literature on the effects of formal adult education at various levels (e.g. Stenberg 2011; Blanden et al. 2012; Blossfeld et al. 2014). As our article analyses the effects of acquiring formal vocational qualifications at the upper secondary level, we focus here on empirical studies of vocational qualifications at that level. Most empirical studies find formal adult education to be associated with positive labour market outcomes such as higher earnings. Findings differ, however, both within and between countries.

Wage effects of formal vocational education likely depend on the institutional context, which varies across countries. From theory, two elements of institutional context can be emphasised: the VET system and the labour market regime. The VET system includes elements like where vocational skills are developed (school vs. workplace) and the degree of employer involvement (Greinert 2004; Jørgensen 2008; Busemeyer and Trampusch 2012). A commonly used categorisation (Greinert 2004) distinguishes between liberal (e.g. US, UK, Ireland), state-based (e.g. Sweden, France, Finland) and dual VET systems (e.g. Germany, Switzerland, Denmark). Formal qualifications from dual systems may have larger effects on wages, as employers are involved in shaping vocational qualifications that match occupational requirements. Second, one feature of the labour market regime (Hall and Soskice 2003) particularly likely to influence the effects of vocational certification, is the wage-setting institution.[2] High collective agreement coverage may lead to larger effects of acquiring vocational qualifications, at least in the short term. Long-term effects remain more uncertain if collective agreements limit wage dispersion, including dispersion related to skills.

In a European perspective, the UK vocational qualification system is characterised by low employer involvement (Fuller and Unwin 2011) and a relatively high degree of fragmentation, with a large number of low-level qualifications. This may lead to small labour market effects of formal vocational qualifications. Furthermore, the low UK collective agreement coverage and decentralised wage setting may also lead to modest effects of formal vocational qualifications, especially in the short term, although decentralised wage setting may lead to greater wage dispersion with ambiguous influence on the effects of acquiring formal vocational qualifications.

The UK evidence is mixed. Jenkins et al. (2003) find positive employment effects of obtaining qualifications, most of them vocational, but no impact on wages. Silles (2007) reach similar findings. De Coulon and Vignoles (2008), on the other hand, report large earnings gains (18%) for qualification attainment between age 26 and 34, especially for women. As the 1970 cohort data used by De Coulon and Vignoles are not ideal for identification, Blanden et al. (2012) used a more representative panel from the British Household Panel Survey (BHPS) and concluded that obtaining (mostly vocational) qualifications as adults has a causal effect only on women's subsequent earnings. For men, any apparent gain is due to selection. Wolf (2011) summarises the UK evidence (not only for adults) and concludes that low-level vocational qualifications (levels 1 and 2) obtained in school are associated with low or negative labour market returns, while some high-level vocational qualifications show positive returns.

Studies from other European countries indicate higher returns to obtaining formal vocational qualifications than in the UK (see, e.g. Blossfeld et al. 2014). This is true both in countries with primarily state-based VET systems with little employer involvement and in countries with dual apprenticeship VET systems with strong employer involvement.

Using an extensive set of Danish registry data covering all birth cohorts 1955–1980, with observations from 1980 to 2009, Wahler et al. (2014) find a positive effect on earnings for adults obtaining vocational qualifications. Participation in vocational upper secondary education increases the chances of income gains for both adult men and women. Participation in general upper secondary education, on the other hand, negatively affects men's chances of income gains, while results for women were inconclusive.

Studies from other Nordic countries find that general education yields greater monetary rewards (see Kilpi-Jakonen and Stenberg 2014 for Sweden; Kilpi-Jakonen, Sirniö, and Martikainen 2014 for Finland). In Sweden, a number of studies have analysed the effects of adult secondary education (both general and vocational) on earnings. Stenberg (2009) discusses the contradictory results in light of different sampling methods and shows that the evidence points to positive private returns. Using a reform that stimulated educational upgrading among low skilled, Stenberg (2011) focuses on detailed data on Swedish siblings aged 24–43 in 1994 to evaluate the impact on annual earnings and finds an average return of 4.4% (in 2004). Other Swedish studies point to positive returns for adults aged 42–55, although only for women (Stenberg and Westerlund 2014).

A plausible explanation for the particularly large effects of vocational education in Denmark may lay in the stratification of the upper secondary system, with formal vocational programmes aimed at matching requirements in the labour market. In contrast, both Sweden and Finland have primarily state-based VET systems with low employer involvement and little emphasis on matching vocational education to occupations.

The German VET system is characterised by vocational tracking and matching of occupations with vocational education. However, a sizeable number of people use the possibilities of revising track choices in adult age (Buchholz and Schier 2015). Biewen and Tapalaga (2017) analyse such transitions using data from the National Education Panel Study, within a sequential counterfactual framework that accounts for selection to different tracks. Their analysis shows generally high wage returns to making transitions at all levels, both for vocational and academic education. Academic/general qualifications have larger wage effects than vocational qualifications, but the heterogeneity across individuals implies that some would be better off by choosing the vocational option. Heterogeneous effects of vocational education are also found by Balestra and Backes-Gellner (2017).

The evidence on the value of certification is of particular interest because one of the two pathways to formal qualifications in our study is basically a formal documentation of skills already acquired. From a theoretical perspective, external certification of skills and monitoring of training achievements provide incentives for high-quality training (Dustmann and Schönberg 2012). The underlying assumption is that certification of any training undertaken will improve employment and wages.

However, the empirical evidence on the effects of certification is mixed. The role of certification itself in signalling skills and/or personal attributes is analysed empirically in some UK studies. A study by Booth and Bryan (2005), based on UK survey data, indicates that a form of certification (accreditation) of firm-based training leads to higher wage returns in future jobs than (similar) non-certified training. In contrast, Wolf, Jenkins, and Vignoles (2006) find that certification does not go along with increased skills and therefore is of low value to firms. In general, the lack of positive effects of low-level vocational qualifications leads Wolf (2011, 154) to conclude 'But the findings underline the failures of education and skill policies based overwhelmingly on qualification reform, and incentivising the accumulation of formal certificates'. Heckman, Humphries, and Mader (2010) review studies of the US and Canadian GED tests. These studies differ from the European studies discussed above as they analyse the effects of passing a test that qualifies for a general diploma on par with the high school degree. Heckman, Humphries, and Mader (2010) and Jepsen, Mueser, and Troske (2017) show that acquiring the GED has little or no effect on labour market outcomes and educational careers. The suggested explanation is that the GED, while showing cognitive skills, does not signal non-cognitive skills such as persistence, motivation and reliability.

Summing up, available evidence on the economic returns to adult vocational certification indicates mostly positive effects on earnings, although less so in the UK than in other European countries. It is unclear whether the differential economic returns can be attributed to institutional differences in VET systems and/or labour market regimes. The variation in effect estimates may also reflect differences in estimation methodology. As we will show, different methodological strategies to deal with selection problems produce different results using the same data. Furthermore, the mechanisms by which formal qualifications lead to higher wages or earnings are typically not identified in empirical studies. Effects can be due to higher skills or signalling, or both. The scarce evidence on 'pure' testing/certification schemes suggests that the effects of certification alone are small, but such evidence comes from settings with institutional features that are very different from those in Norway.

3. Institutional context of the study

Our study is about vocational qualifications at the upper secondary level (EQF level 4). For Norwegian youth, almost all vocational upper secondary education is based on a combination of school and apprenticeship. The main model is 2 years in school, followed by a 2-year apprenticeship. During the apprenticeship period, the apprentice is employed in an approved firm responsible for providing training of sufficient quality. Employer associations and trade unions take part in governing structures at both the national and county levels, but educational authorities formally have the final word. Apprentice wage levels are stipulated by collective agreements between employer and labour organisations within the relevant industry. Formal qualifications are obtained by passing exams and a final practical-theoretical test of occupation-specific skills. All formal vocational qualifications based on apprenticeships are aimed at matching the requirements of specific occupations.

For adults, there are two routes to formal vocational upper secondary qualifications: adult apprenticeship and the experience-based route. First, adults may become adult apprentices, and have all their training at the workplace, apart from that in general subjects. Such apprenticeship training takes from 1 to 4 years full time at the workplace. The number of years depends on the qualification and the competence each individual has previously acquired through school and work practice. Two years are most common. School-based learning in general subjects takes place in

classes for adults. The number of hours will depend on already acquired competence in such subjects. Adult apprentices may already work in the company or be recruited from outside. Second, adults who can document long and varied practice as unskilled workers within a relevant trade can register for the trade examination and acquire the trade certificate, usually after taking a shorter theoretical course. They need to pass both a written exam specific to their trade and the main practical-theoretical test, which is assessed by an external assessment committee of experienced skilled workers within the industry. This experience-based route accounts for about one-third of all new trade certificates each year. In terms of formal qualifications, both the adult apprenticeship and the experience-based routes provide the same trade certificates as completing the upper secondary vocational track as a regular student/apprentice.

Table 1 gives an overview of all new Norwegian trade certificates and other vocational qualifications acquired over an 18-year period (1998–2015). Almost half of the certificates during this period (47%) were issued to persons aged 25 or older. Two-thirds of the experience-based certificates were to persons who obtained upper secondary vocational qualifications for the first time. Among new certificates obtained through adult apprenticeships, about one half were to adults without prior formal qualifications at the upper secondary level. The labour market returns to vocational qualifications may differ for those who raise their educational attainment, compared to those who widen or acquire new qualifications at the same level of attainment. In this study, we focus on the effects of acquiring the vocational trade certificate for those without prior upper secondary qualifications.

The effects of a vocational trade certificate on earnings may arise via improved wage growth as an employee, reduced likelihood of spells of non-employment, or more favourable earnings as self-employed. General collective agreement coverage in Norway is high when compared to that in Anglo-American countries, but lower than in the other Nordic countries (Nergaard 2016). However, coverage is high in industries where most of the formal vocational qualifications acquired by adults are relevant. In 2014, collective agreement coverage was 57% in the private sector and 100% in the public sector (Nergaard 2016). Within collective agreements, there are typically provisions for wage increases if the employee obtains a trade certificate that is relevant for the job. Wage structures are more closely linked to formal qualifications for women than for men, reflecting the higher female employment share in the public sector and their lower entrepreneurship and self-employment rates. Accordingly, wage returns to obtaining vocational qualifications might be expected to be higher for women.

We may expect the immediate wage effects of vocational qualifications to be larger in Norway than in countries with less coordinated wage setting. However, the greater direct impact of formal qualifications on wages might be partially offset by the more compressed wage structure when compared to liberal, less coordinated economies. Norwegian formal VET qualifications are broad but still aimed at matching skills needs in a specific occupation (Nyen and Tønder 2014). One might

Table 1. Trade certificates. Vocational qualifications and additional certificates. 1998–2015.

	Vocational qualifications	
	Adults (age 25+)	Youth (age < 25)
Experience based	134,222	Not
First qualification (%)	66.6	relevant
Additional qualification (%)	33.4	
Apprenticeship	34,837	189,271
First qualification (%)	51.8	100
Additional qualification (%)	48.2	
Vocational qualifications without a trade certificate	45,450	54,128
Total	214,509	243,399
Of which first upper secondary qualification with a trade certificate	107,438	

Note: Information on trade certificate acquisition is available from Statistics Norway from 1998 onwards. Additional qualification means that the person had already completed upper secondary education at the time of the new qualification. Source: Bratsberg, Nyen, and Raaum (2017) and National Education Database (Statistics Norway).

expect such formal qualifications to be associated with skills that are relevant and productivity enhancing, affecting wages through productivity gains. The two routes to adult qualifications differ. While the experience-based scheme primarily documents skills already acquired, adult apprentices accumulate new skills. As such, any labour market effects from the experience-based scheme will largely be due to the information value of certification, while for adult apprenticeships, effects will reflect both increased skills and the information value. Note that effects of certification do not presuppose worker mobility, as the present employer may be willing to raise wages to keep employees who have gained new formal qualifications.

4. Data

Our sample is based on all Norwegian-born residents from ten birth cohorts (1973–1982) who by the age of 25 had not completed an upper secondary education (hereafter, 'dropouts'). Drawing on administrative registers, we track their educational attainment through 2017 and their labour market outcomes through 2016, meaning that we follow the oldest cohort in the labour market up to age 43 and the youngest cohort to age 34.[3] The data allow us to identify the age at which they acquire any adult vocational qualification. The sample covers three groups of dropouts: those who later attain vocational qualifications either via an adult apprenticeship or through the experience-based route, and those who by the end of the observation window remain without qualifications. Due to the focus on vocational qualifications acquired through workplace learning, we exclude from the sample those who acquired academic degrees or school-based vocational degrees. We also exclude individuals with permanent disability benefits at age 25.

In Figure 1, we display, by age, the cumulative fraction of the sample that acquired the vocational trade certificate at the upper secondary level. For adult apprenticeships, there are very few certificates issued to persons over 35 years of age. By age 43, 5% of both men and women had acquired qualifications via apprenticeships. A majority of adult vocational qualifications are attained through the experience-based route. The likelihood of acquiring adult certification is higher for males than for females. By age 43, 15% of the male dropouts held an experience-based vocational trade certificate,

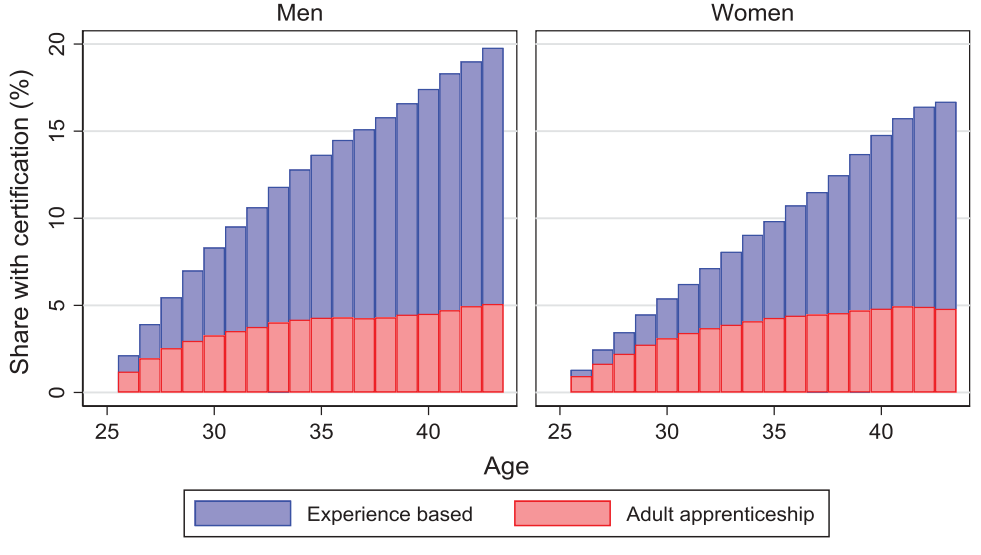

Figure 1. Take-up of vocational trade certificates among dropouts age 25.

Note: Sample consists of the 1973–1982 birth cohorts born in Norway and without upper secondary qualifications at age 25.

compared to 12% among women. In absolute numbers, the gender difference is even larger as men are more likely than women to be without qualifications at age 25.

Our main individual outcome variable is the annual sum of labour earnings from wages and self-employment income. Among employees, the effect estimate captures the combined impacts of qualifications on the hourly wage and hours worked during the year, including spells of unemployment. Information on both earnings sources are drawn from administrative records summing over all items filed for tax purposes. Annual wages are reported directly by employers and earnings of self-employed are collected from balance sheets of individual businesses.

Figure 2 displays earnings profiles, separately by gender, for the three groups of individuals according to their upper secondary attainment status at the end of the data window. The displayed earnings profiles are averages by age, reflecting a mix of pre and post-attainment years for the two vocational qualification groups, and include observations with zero (and, for self-employed, even negative) earnings. First, we see that earnings differentials at age 43 are substantial. Workers with experienced-based qualifications earn much more than those who acquired qualifications as adult apprentices, who in turn have significantly higher earnings than those without qualifications. Second, the earnings premium of those with experience-based qualifications is evident already at age 25. This clearly suggests that positive selection is a major issue when it comes to estimating the economic returns to adult vocational qualifications. Third, the earnings profile of the adult apprentice group is steeper than for the other groups, with earnings that are comparable at age 25 to those who do not obtain qualifications. The steepness may reflect low earnings during the apprenticeship period, post-qualification effects or individual-specific earnings potentials causally unrelated to the attainment of vocational qualifications. In section 5, we discuss the econometric model that enables us to credibly identify any causal effects of vocational qualifications on earnings.

Men and women without formal upper secondary qualifications are frequently enrolled in school or training in adulthood. Because our identification strategy is based on earnings differentials within individuals – comparing labour earnings before and after the acquisition of vocational qualifications – only years with (potential) labour force participation are relevant. Therefore, in our study of earnings effects, we exclude years when a person is enrolled in school or formal training since earnings during this period are poor measures of counterfactual earnings, i.e. what those who attain qualifications

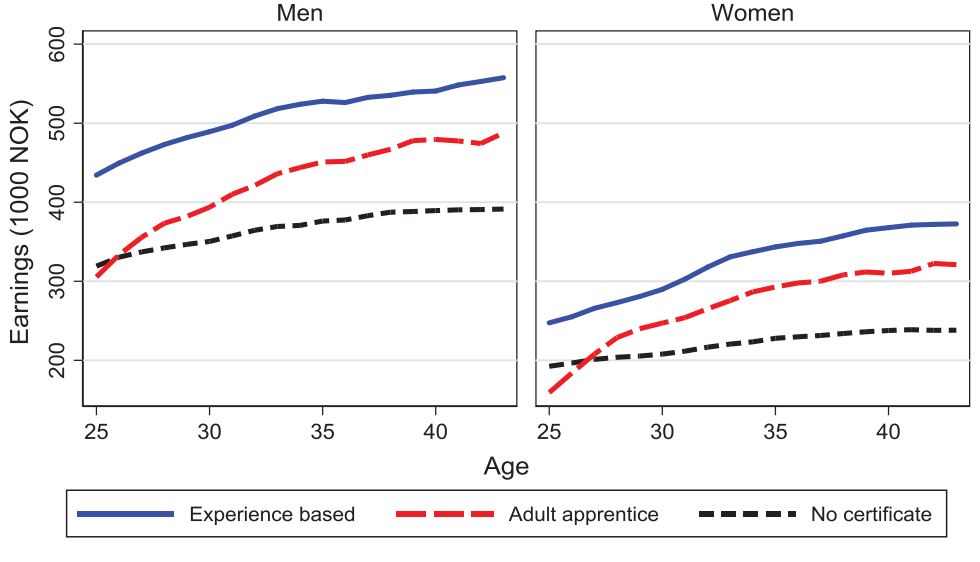

Figure 2. Earnings profiles by adult vocational qualifications.

Note: Annual earnings are inflated to 2015 NOK using the index of the social security administration ('G'). See also note in Figure 1.

Table 2. Sample characteristics, regression samples.

	Men			Women		
	Exp. based	Apprentice	No qual	Exp. based	Apprentice	No qual
	(1)	(2)	(3)	(4)	(5)	(6)
Age	31.4	32.4	31.2	31.5	32.5	31.4
Age at qualification	32.0	29.1		34.2	29.5	
Earnings	498,428	439,690	362,448	310,272	281,544	218,780
Earnings if employed	514,967	480,801	455,190	340,956	334,023	316,504
Earnings age 25	446,071	343,697	335,937	257,526	181, 954	202,563
Employment 25 (%)	95.1	84.1	80.4	83.5	64.5	65.5
Qualification from public sector (%)	7.5	8.4		53.1	45.3	
Individuals	6350	2509	47,738	3268	1665	32,283
Individual × year obs	94,572	28,545	721,110	48,051	19,235	494, 051

Note: Annual earnings are inflated to 2015 NOK using the index of the social security administration ('G'). Earnings if employed are conditional on earnings exceeding 1G. Years with registered enrolment in the national education database are excluded.

would have earned in the absence of qualifications. In our data, nearly 90% of men and women in the adult apprentice category were enrolled in training or school in the 3-year period before obtaining the qualification (see Appendix Figure A1). Among those who acquired qualifications via the experience-based route, around 20% were enrolled in the year prior to certification. Even among those without formal qualifications, about 10% were enrolled during their mid-twenties, gradually declining with age.

Descriptive characteristics of the sample used to estimate earnings effects are displayed in Table 2, separately for the three categories of dropouts and by gender. As the table shows, compared to those with an experience-based certificate, individuals who obtain qualifications via apprenticeships earn on average less at age 25 and are younger when they attain qualifications. Compared to men, women are older and much more likely to be employed in the public sector at the time of attainment. The table also reveals substantial earnings differentials across qualification categories at age 25, even when we omit those enrolled in school or training.[4]

5. Identification of vocational qualification effects – empirical strategy

The selective take-up of formal adult qualifications forms a major challenge for the identification of effects of vocational qualifications on labour market outcomes. In practice, we identify earnings effects by comparing outcomes of individuals before and after attainment. Our empirical model departs from a standard earnings regression

$$y_{it} = \alpha_t + \sum\nolimits_k \beta_k VQ_{kit} + \sum\nolimits_a \gamma_a A_{ait} + \varepsilon_i + u_{it} \quad (1)$$

where y_{it} denotes the labour earnings of individual i in year t. Vocational qualifications, VQ_{kit}, is an (absorbing) qualification indicator that equals unity in years around attainment ($k = 0$ in the qualification year; in the analyses we let k run from −6 to 9). For simplicity, the notation ignores that we estimate different coefficients (β_k) for adult apprenticeships and experience-based qualifications. Age is measured by a set of dummies of age a in year t (A_{ait}, in the analyses a runs from 23 to 43), and α_t is a vector of year of observation dummies. We allow for correlated residuals (u_{it}) across time by clustering standard errors within individuals.

As Figure 2 clearly revealed, those who acquire experience-based vocational qualifications are positively selected in terms of pre-qualification earnings. There is an evident need to account for unobserved heterogeneity. Thus, ε_i is the individual fixed effect capturing the effects of characteristics such as ability, personality and family background.

With the individual fixed effects specification, the effects of VQ on future earnings are identified from differences between pre and post-qualification outcomes within individual earnings histories. However, the shape of the lifecycle earnings profile differs for those who acquire qualifications and those who do not and there may be heterogeneity in individual earnings growth, even within the

group that eventually acquires qualifications. If those with personal characteristics that are highly rewarded in the labour market in terms of superior earnings growth also tend to acquire qualifications early in their career, there will be a correlation between the error term and the timing of vocational qualifications among those who (eventually) attain qualifications. The effect estimates based on Equation (1) will then be biased upwards as identification of post-qualification effects will draw heavily on those with high individual earnings trajectories. Such heterogeneity and selection bias may also arise from the employer side if firms that offer better opportunities for training and task allocation that make workers qualified for certification, at the same time pay higher wages. This motivates an extension that allows for further heterogeneity (following, e.g. Pischke 2001) where the empirical model is

$$y_{it} = \alpha_t + \sum\nolimits_k \beta_k VQ_{kit} + \sum\nolimits_a \gamma_a A_{ait} + \phi_i T_{it} + \varepsilon_i + u_{it} \ , \tag{2}$$

where T_{it} is a trend variable for the individual, measuring years of experience. The earnings profiles in this model are individual-specific with a linear trend. The model implies that individual earnings deviate from a common age profile along two dimensions. First, each individual has a specific earnings level across all outcome years (ε_i). Second, for every year there is an individual component of earnings growth assumed to be constant for individuals across years (ϕ_i). The role of those who never acquire qualifications is to identify common factors like calendar time.[5]

The extended specification places additional requirements on the longitudinal data used to identify the parameters of the model. In particular, to contribute to identification, each individual must be represented with at least three observations and there must be a sufficient variation in earnings within an individual to allow for estimation of the individual experience profile and qualifications effect in addition to the individual fixed effect. Because we exclude years when the person is enrolled in school, the individual growth component is measured by the trend in years out of school (or potential work experience). Earnings profiles are typically estimated using log earnings. As described below, our samples contain a fair number of observations with zero (or very low) earnings. In such a case, the log earnings specification will ignore the important extensive margin of labour force participation. For this reason, in the baseline estimation of Equation (2) we use earnings levels. To check the sensitivity of results in this formulation, when we study effects of qualifications in the subsample of employed individuals, we present results from analyses using both earnings levels and log earnings as the dependent variable.

6. Results

Our main results are displayed in Figure 3. As we will compare earnings differentials between post and pre-qualifications years, all earnings effects are expressed as differentials from earnings 3 years ahead of attainment of qualifications, illustrated by the scatter point at (−3,0) in the figure. Estimates are based on the model that allows for individual heterogeneity in both level and slope; see Equation (2).

Earnings of men who attained qualifications after completing an apprenticeship receive a boost from the qualification of 52 500 NOK (5 250 Euro) the year of acquisition, rising to an average of 77 000 NOK during the first five post-qualification years (see the lower panels of the figure). For women, the effects are slightly higher. These are substantial gains, amounting to 17% of the sample average earnings of men and 27% of the average earnings of women in the apprenticeship group. The earnings gains remain positive throughout the 5-year post-period for both men and women. Although we exclude years when enrolled in education or training, there is a visible negative effect in the year preceding qualifications. With earnings that are measured annually, this drop likely reflects a transition period between the end of the apprenticeship and attainment of qualifications.

The estimated earnings gains for individuals who acquire the experience-based certificate are less favourable than those of adult apprentices; but for both men and women, we find statistically significant effects throughout the 5-year post-acquisition period. According to the upper panels of

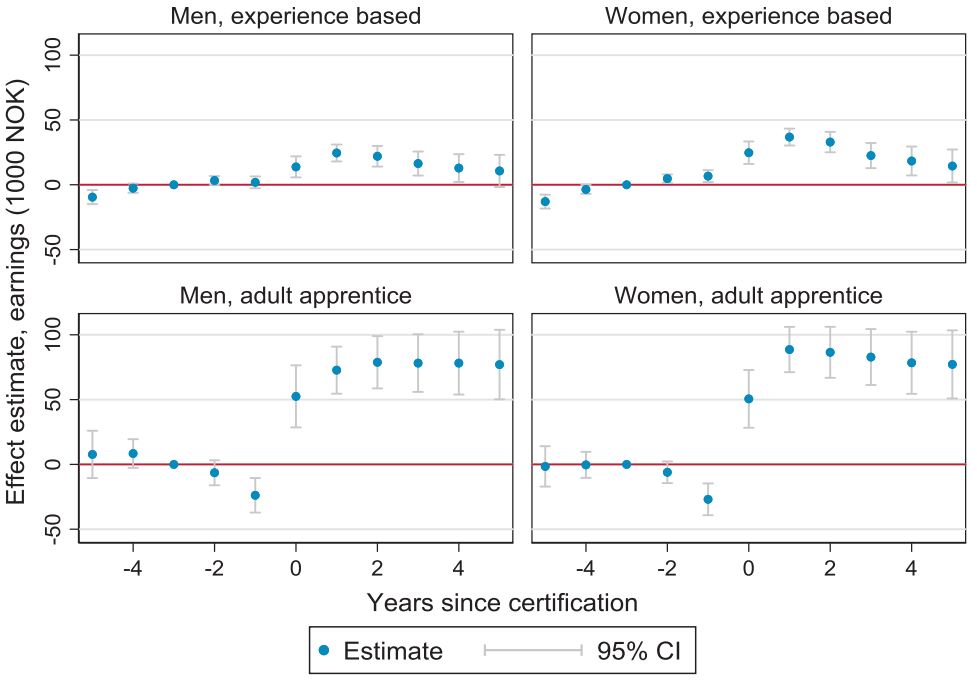

Figure 3. Estimated earnings effects. Apprenticeship and experience-based certificates.
Note: See Appendix Table A1 for the full set of regression results.

Figure 3, males receive 13 800 NOK higher earnings during the year of qualification. The effect profile over the post-acquisition period is hump-shaped, with a peak of 24 500 NOK and a gain of 10 700 NOK (*p*-value 0.092) after 5 years. For women, the gains are larger with an estimated peak annual earnings gain of 36 800 NOK the year after acquisition, tapering off to 14 500 NOK (*p*-value of 0.026) after 5 years. Relative to their sample means, these gains amount to 5% (peak year) and 2% (5-year gain) for men, and 12% (peak) and 5% (5-year gain) for women.

These estimates of returns to experience-based qualifications overlook any contemporaneous effects of pre-certification learning, even though the certifying institution may be expected to stimulate learning at work. In fact, Figure 3 indicates slight earnings growth for the experience-based group during the years leading up to certification – consistent with rewards to learning at the workplace. If such rewards are fully realised prior to attainment, we can assess the returns to pre-certification learning and isolate the returns to certification by examining earnings growth across three periods: a base period 3–5 years before attainment, the 2-year period immediately prior to attainment, and the post-attainment period. (In this exercise we allow for flexible earnings effects following qualification, as well as differential earnings prior to the base period.) This exercise yields estimates of returns to pre-certification learning of 1% for men and 3% for women. The exercise also moderates the estimated effects of certification, such that, relative to the immediate pre-attainment period, estimated returns to certification are 4% (peak) and 1% (5 years) for men and 10% (peak) and 2% (5 years) for women. See Appendix Table A4 for complete results.

Accounting for individual earnings growth, independent of qualifications or not, is a crucial component of our identification strategy. With more restrictive model specifications, estimated returns to qualifications are much larger. In Appendix Figures A1 and A2 and Table A2, columns (3)–(6), we report estimates from OLS and the standard fixed effects model without individual slope components. For apprentices, the profiles of estimated earnings gains have similar shapes to those in Figure 3, but magnitudes are overstated. To illustrate, compared to estimates in Figure 3, the OLS

estimate overstates the returns to apprenticeship qualifications 5 years after attainment by 8% for men and 20% for women. For experience-based qualifications, the more restrictive specifications attribute a much larger part of earnings growth to the attainment of qualifications, and the OLS effects are estimated to be both larger and longer lasting than in the preferred model. Again compared to estimates in Figure 3, 5 years after attainment estimates from both the OLS and ordinary fixed effects models overstate returns to experience-based certification by more than 200% for men and more than 115% for women.

In Appendix Figure A4 and Table A1, we show that the distributions of estimated individual earnings heterogeneity square well with predictions. On average, those who obtain vocational qualifications have higher earnings growth (the estimated slope coefficients) than those who do not acquire qualifications. Experience-based qualifications are associated with substantially higher intercepts, consistent with the early-career earnings differentials shown in Figure 2.

For wage earners, annual earnings are the product of hours worked and the hourly wage. The earnings effects can be attributed to higher employment or jobs that are better paid. In order to shed light on the relative effects of attainment on employment and wages, we estimate earnings effects conditional on employment. Employment is defined annually as having earnings exceeding the threshold of one basic social insurance unit (G), equal to NOK 92 000 in 2016 (approx. Euro 9 200), reducing the male sample by 20% and female sample by 31%. If qualifications raise employment, we expect to find lower earnings effects among the employed, when compared to the unconditional estimates in Figure 3. As everyone in the subsample of employed individuals has positive earnings, we follow the standard practice and estimate the model in logs (see Appendix Table A3 for estimates from both the level and log specifications). The results from this exercise are displayed in Figure 4. Among those who attained qualifications through apprenticeship, estimated effects are cut by approximately one half when we condition the sample on employment. For both men and women with experience-based qualifications, estimates are slightly lower when we condition on

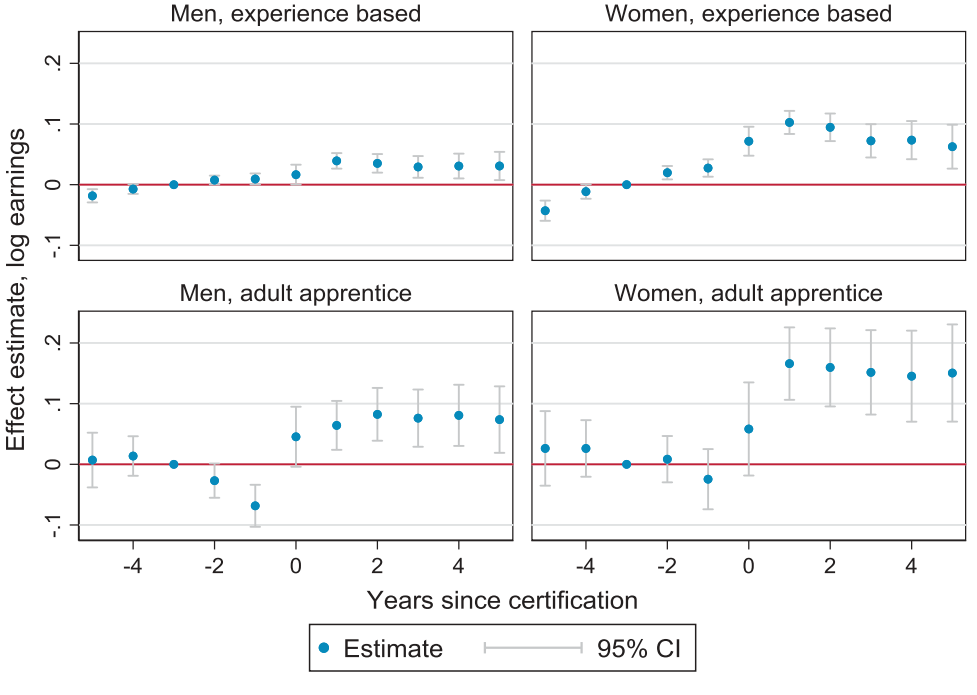

Figure 4. Estimated effects of qualifications on log earnings among the employed. Apprenticeship and experience-based certificates.

employment. While qualifications acquired through adult apprenticeships raise employment as well as wages, the earnings gain associated with experience-based qualifications foremost reflects better pay among the employed. Presumably, this reflects that the experience-based route naturally involves steady employment: As shown in Table 2, more than 9 of 10 of those who acquire qualifications via experience-based certification were employed at age 25.

Women and men obtain vocational qualifications in different crafts and sectors. The larger effects for women reflect that they qualify for jobs and upward wage mobility in sectors with greater emphasis on formal qualifications in hiring and promotion processes. Collective agreements typically remunerate formal qualifications, and collective agreement coverage is higher in the public sector. Figure 5 confirms that earnings effects are larger in the public sector. For both apprenticeships and the experience-based route, earnings effects are larger for those who acquired qualifications while employed in the public sector compared to those in the private sector.[6] Actually, the observed gender difference in average earnings effects is attributable to the larger share of women employed in the public sector. Within the sector, earnings effects are similar for men and women.

7. Discussion and conclusion

Although the evidence on labour market returns to acquiring formal vocational qualifications in adulthood is mixed, most studies show positive effects. Effect estimates vary across countries, indicating that institutional factors play a role. However, studies also differ methodologically, and the strategies to overcome inherent selection problems and establishing credible counterfactuals vary a lot. Consequently, some of the variations across studies may reflect differences in empirical methods. The rich longitudinal data available from Norwegian registers offer opportunities to address selection issues, and we illustrate this by alternative estimates of earnings effects using different sets of fixed effects models. Even prior to attainment, those who eventually acquire formal

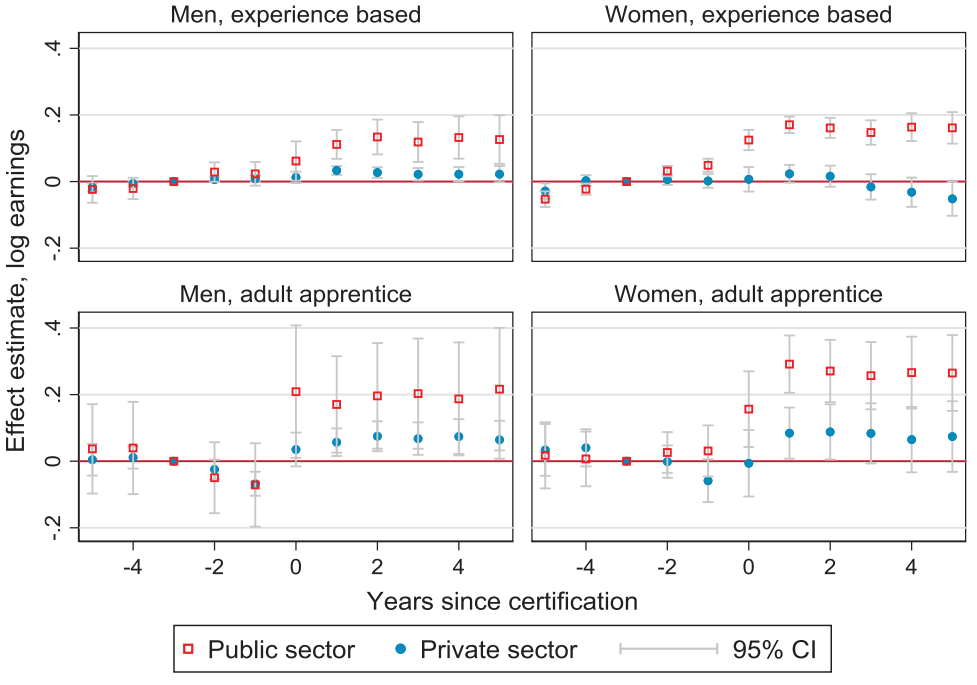

Figure 5. Estimated effects on log earnings by sector of acquisition, subsamples of employed individuals. Apprenticeship and experience-based certificates.

vocational qualifications have higher earnings growth than those who do not. Less rigorous models tend to exaggerate earnings effects. Our preferred fixed effects model takes into account that not only earnings levels but also earnings growth differs across individuals and may be correlated with the likelihood of attaining adult vocational qualifications.

Our study identifies the earnings effects of two alternative routes to adult vocational qualifications in the same labour market. While the experience-based route provides certification of competence acquired through informal or non-formal learning as an ordinary employee, adult apprentices go through a training period before they acquire their qualifications. Labour market effects of the experience-based route will primarily arise from the certification itself. Certification provides verified information about skills and personal characteristics to external employers, raising the outside option and improving the bargaining power of the employee. The apprentice-based route, on the other hand, involves a substantial human capital component, so any labour market effects could be due to both the certification and increased competence.

Our evidence confirms that the economic returns to certification through the experience-based route are much lower than when attainment of qualifications also involves a substantial skills component. We find that formal qualifications acquired through adult apprenticeships lead to considerable and lasting earnings increases for both men and women (17% and 27% of the sample mean earnings, respectively). The earnings effects of experience-based qualifications are substantially lower (2% and 5% after 5 years), although from a much higher starting point. Certification via the experience-based route also pays off in the longer run with statistically significant estimated earnings effects after 5 years. One way to understand the difference in effects is to consider the alternative value of not achieving qualifications. For those who attain qualifications through the experience-based route, the alternative would normally be to continue working without formal qualifications. For those who achieve qualifications through adult apprenticeships, the alternative would include a higher probability of non-employment and limited access to jobs that require vocational competence. In this respect, the measured effects reflect that the two routes by nature serve different groups, and estimated returns should be interpreted accordingly. The experience-based route requires considerable previous work experience. It is relevant within occupations that can be entered without formal vocational qualifications. Adult apprenticeships involve much more actual training but is open to a wider target group, including those wanting to enter occupations where unskilled work is less common. It is also a route that can be used by individuals outside the labour market, with little or no previous work experience.

The analysis reveals substantial gender differences in returns, where women gain more than men. However, we also find larger effects of formal qualifications acquired in the public sector. Women are more likely to work in the public sector, and the sectorial affiliation fully explains the gender difference in returns. The larger effect in the public sector likely reflects the higher coverage of collective agreements and the more rigid pay scales where formal qualifications are explicit criteria for wages.

Considering policy implications, our findings do suggest that employees benefit in terms of higher future earnings if they take advantage of the opportunity to certify their competencies through the experience-based route. The gains are not large; however, the costs of the certification institution in terms of foregone production are also low since the competence to a large degree is gained informally through productive work. Furthermore, qualitative studies indicate that certifying institutions such as the experience-based route stimulate learning at work (Tønder and Aspøy 2017), which is consistent with theoretical models of certification of firm-based training (e.g. Acemoglu and Pischke 2000; Dustmann and Schönberg 2012). Our analysis provides some support for this notion, as we find increased earnings growth *ahead* of certification for those who qualify through the experience-based route.

The substantial returns to adult apprenticeships suggest that these investments should be stimulated; keeping in mind that policies giving firm incentives to establish adult apprenticeship

contracts may crowd out apprenticeships for youth. Overall, the two routes to formal vocational qualifications for adults are complementary; they serve different groups.

Notes

1. A credentialist approach (Collins 1979) would also point to qualifications per se rather than underlying skills as driving labour market returns but would attribute this to filtering used as a power resource for groups rather than to signalling of personal characteristics.
2. Others point to differences in welfare regimes in explaining participation and effects of lifelong learning activities (e.g. Blossfeld et al. 2014).
3. Below we show that results are similar if we restrict the data to a balanced sample that we track up to age 40. The chief advantage of the unbalanced data is the larger sample size.
4. Although the sample is restricted to individuals who remained dropouts at age 25, we augment the regressions with earnings at age 23 and 24 in order to bolster the observation count of pre-qualifications earnings.
5. Effects of age, time and attainment are intertwined. First, consider single cohort data, where we cannot separate age and time as we move 1 year ahead; each individual moves from age a to a + 1 and from t to t + 1. Second, if all individuals acquire qualifications at the same age, we could not separate the age-related growth from the effect of qualifications, unless the age effect was identified parametrically or from another group. Fortunately, our data cover several birth cohorts and enable us to identify the effects of ageing separately from calendar time effects. More importantly, switchers acquire qualifications at different ages. Thus, we can estimate the age profile within the group of individuals who end up with qualifications, assuming that the underlying age profile is independent of age at attainment.
6. Differences in estimates across the sector are statistically significant at the 1% level for three of the four groups considered. The exception is the male apprentice group, for which point estimates are similar to those for women but less precise owing to the much smaller observation count of male apprentices in the public sector.

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